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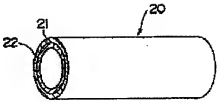
TITLE : SEMICONDUCTIVE SHRINKING TUBE





ABSTRACT : PROBLEM TO BE SOLVED: To uniform shrinkage percentage in heat shrinkage by laminating a bridged slirinking tube material which includes polyolefine and carbon black in two layers or more, and making bridging percentage of an internal layer larger than that of an adjacent external layer.

SOLUTION: In a shrinking tube 20, bridged shrinking tube members 21, 22 which include polyolefine and carbon black are laminated in two layers as an internal layer and an external layer respectively. The bridging percentage of the external layer 21 is 50% and that of the internal layer 22 is 80%, namely, the bridging percentage of the internal layer 22 is larger than that of the external layer 21. When a body to be attached is inserted into the inner diameter and is heated by infrared heater or the like, it shrinks and comes into close contact with the body to be attached. However, shrinkage occurs in a lengthwise direction as well as in a bore direction of the shrinking tube 20, and higher shrinking force occurs as the bridging percentage becomes larger, therefore, the internal layer 22 shrinks higher than the external layer 21. As a result, the shrinking tube is crimped against the body to be attached strongly by the resultant force of shrinking force in the bore direction and that in a lengthwise direction, thus making it possible to bring the tube into uniformly close contact in the lengthwise direction.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the half-conductivity contraction tube used for the connection of a bridge formation polyolefine insulation power cable.

[0002]

[Description of the Prior Art] On the occasion of connection of a bridge formation polyolefine insulation power cable (only henceforth a "power cable"), in order to form a semi-conducting layer in a connection, a half-conductivity contraction tube (only henceforth a "contraction tube") is used. An example of the connection of the power cable using a contraction tube is shown in drawing 3 . In drawing 3 , the enveloping layer which consists of the internal semi-conducting layer 3, an insulator 4, and an external semi-conducting layer 5 is formed in the perimeter of a conductor 2 one by one, respectively, and power cables 1a and 1b become, among these an insulator 4 is formed from cross-linked polyethylene, and the internal semi-conducting layer 3 and the external semi-conducting layer 5 are formed from the cross-linked polyethylene containing carbon black.

[0003] In this connection, it is cut so that the whole enveloping layer may reduce the diameter gradually towards a terminal, a conductor 2 is exposed at a terminal, exposure terminal 2a of both conductors and 2b are inserted into a conductor connector tube 7, and the terminal of power cables 1a and 1b is compared in that interior. It applies to the terminal which the internal semi-conducting layer 3 of each power cable exposed from the periphery of this conductor connector tube 7. So that it may be stuck to the contraction tube 10 and the periphery of this contraction tube 10 and the terminal which the insulator 4 of each power cable 1a and 1b exposed may be covered The layer of the reinforcement insulator 8 which consists of cross-linked polyethylene is fabricated, the periphery and terminal which the external semi-conducting layer 5 of each power cable 1a and 1b exposed are covered further, it is stuck to the contraction tube 11, and the connection is formed. As for power cables 1a and 1b, each internal semi-conducting layer 3 and external semi-conducting layer 5 are connected through the above-mentioned contraction tubes 10 and 11 by this.

[0004] The conventional contraction tubes 10 and 11 used in the above-mentioned connection A polyethylene and polyethylene-ethyl acrylate copolymerization object (EEA), The compound which mixed with cross linking agents, such as carbon black and organic peroxide, to polyolefines, such as a polyethylene-vinyl alcohol copolymerization object (EVA) After fabricating in a tube and constructing a bridge by heating or electron beam irradiation, it is manufactured by the approach of cooling expanding aperture of a tube at the temperature more than the melting point of said polyolefine (diameter expansion), and maintaining the expanded aperture.

[0005] In order to give these contraction tubes 10 and 11 to a connection, insert beforehand adherends, such as a conductor connector tube 7 or the reinforcement insulator 8, in the contraction tubes 10 and 11 with larger aperture than these outer diameters, and next heat these contraction tubes 10 and 11, it is made to contract, and the approach of sticking to adherend is taken. Power cables are varieties and that in which the outer diameter of the adherend in these connections and the contraction tube which inserts in such adherends since it is various have, the thing of diameter expansion, i.e., the various rates, of aperture of varieties, is prepared.

[0006]

[Problem(s) to be Solved by the Invention] However, when the rate of diameter expansion was made above large to some extent and heating contraction was carried out, as especially the terminal of a tube showed to contraction at irregular ******, drawing 4 (a), and (b), the fault which the terminals 12a and 12b of the contraction tube 12 do not stick to Adherend S, separates, or a fold produces might produce the conventional contraction tube. In order that this invention may solve the above-mentioned technical problem, it is made, therefore the purpose is in offering the contraction tube with which contraction was equalized on the occasion of heating contraction.

[0007]

[Means for Solving the Problem] The above-mentioned technical problem is solvable by offering the half-conductivity contraction tube which the laminating of the contraction tube member containing polyolefine and carbon black over which the bridge was constructed was carried out to the multilayer

more than two-layer, and was made into size by the inner layer from the outer layer where the degree of cross linking (gel molar fraction) of each class adjoins. A degree of cross linking (gel molar fraction) is an index which shows extent of bridge formation of polyolefine here, for example, the amount for the dissolved residue to solvents, such as a xylene, can express. A degree of cross linking (gel molar fraction) is size, so that the amount of dissolved residue is size.

[0008]

[Embodiment of the Invention] Hereafter, an example explains the gestalt of operation of this invention using a drawing.

(Example 1) One example of the contraction tube of this invention is shown in drawing 1 . It comes to carry out the laminating of the contraction tube members 21 and 22 in which this contraction tube 20 contains polyethylene and carbon black, respectively and over which the bridge was constructed to two-layer as an outer layer and a inner layer, respectively, and that bore is set to 20mm - 300mm, and thickness is set to 2mm. And an outer layer 21 is [ 50% and a inner layer 22 ] 80%, and, as for the degree of cross linking of these layers, let the degree of cross linking be size for the inner layer 22 from the outer layer 21.

[0009] If this contraction tube 20 inserts adherend with an outer diameter of 100mm in that that bore of whose is 150mm, for example and heats it at an infrared heater etc., it will contract and it will be stuck to adherend. At this time, contraction takes place only in the aperture direction of the contraction tube 20 also in the die-length direction. And since such stronger contraction that a degree of cross linking serves as size is caused, the way of a inner layer 22 will contract the contraction tube 20 in the aperture direction and the die-length direction more strongly than an outer layer 21. Consequently, in that terminal, as for the contraction tube 20, the fault which is strongly stuck to adherend by pressure by resultant force with the shrinkage force of the aperture direction and the shrinkage force of the die-length direction, and sticks in the die-length direction at homogeneity, and a terminal is isolated from adherend or a fold generates will not happen. Moreover, since it is formed in two-layer, even if a pinhole exists in one layer, it will become the contraction tube which does not have a pinhole as the whole, and quality will be stabilized.

[0010] This contraction tube 20 can be manufactured by cooling to a room temperature, where it expanded the diameter, having piled up the contraction tube member which is two kinds from which a degree of cross linking differs, and heating to the temperature more than the melting point of polyethylene and the diameter is expanded. The degree of cross linking of each contraction tube member to pile up can be adjusted by changing the amount and/or bridge formation time amount of the cross linking agent added to a molding compound etc.

[0011] (Example 2) The second example of the contraction tube of this invention is shown in drawing 2 . It comes to carry out the laminating of the contraction tube members 31, 32, and 33 in which this contraction tube 30 contains polyethylene and carbon black, respectively and over which the bridge was constructed to three layers, an outer layer, a middle lamella, and a inner layer, respectively, and that bore is set to 150mm and thickness is set to 2mm. and the degree of cross linking of these each class -- an outer layer 31 -- 40% and a middle lamella -- 32 is carried out 60%, and a inner layer 33 is made into 85%, and let the degree of cross linking be size from the outer layer 31 at the order of medium-rise 32 and a inner layer 33.

[0012] If this contraction tube 30 inserts adherend with an outer diameter of 100mm and heats it at an infrared heater etc., it will contract and it will be stuck to adherend. At this time, contraction takes place only in the aperture direction of the contraction tube 30 also in the die-length direction. and -- since such stronger contraction that a degree of cross linking serves as size is caused -- the contraction tube 30 -- the aperture direction -- the die-length direction -- an outer layer 31 and a middle lamella -- it contracts strongly by the order of 32 and a inner layer 33. Consequently, in that terminal, as for the contraction tube 30, the fault which is strongly stuck to adherend by pressure by resultant force with the shrinkage force of the aperture direction and the shrinkage force of the die-length direction, and sticks in the die-length direction at homogeneity, and a terminal is isolated from adherend or a fold generates will not happen. Moreover, since it is formed in three layers from which a degree of cross linking differs and the buffer force and whenever [ tough ] are changing gradually even if it not only becomes a contraction tube without a pinhole, but external force is applied, it becomes the contraction tube of the quality which neither a pinhole nor a crack can produce easily.

[0013]
[Effect of the Invention] As explained above, the half-conductivity contraction tube of this invention Since the laminating of the contraction tube member containing polyolefine and carbon black over which the bridge was constructed is carried out to the multilayer more than two-layer and it considers as size by the inner layer from the outer layer where the degree of cross linking (gel molar fraction) of each class adjoins When inserting and heating adherend, contraction becomes irregular, a terminal is isolated from adherend, or folding in a terminal is prevented, and it comes to stick to adherend over the whole region of the used contraction tube at homogeneity. Moreover, since it considers as multilayer structure, a pinhole does not occur, but the half-conductivity contraction tube of quality strong against external force is obtained. By using the half-conductivity contraction tube of this invention, a homogeneous internal semi-conducting layer and an external semi-conducting layer come to be formed in the connection of a power cable.

ーブ２０は、その端末において口径方向の収縮力と長さ方向の収縮力との合力によって被着体に強く圧着され、長さ方向に均一に密着し、端末が被着体から遊離したり、襞が発生したりする不具合が起こらなくなる。また、２層に形成されているため、たとえ一層にピンホールが存在したとしても、全体としてはピンホールがない収縮チューブとなり、品質が安定する。

【００１０】この収縮チューブ２０は、架橋度が異なる２種類の収縮チューブ部材を重ね合わせてポリエチレンの融点以上の温度に加熱しながら拡径し、拡径した状態で室温に冷却することによって製造できる。重ね合わせるそれぞれの収縮チューブ部材の架橋度は、成形コンパウンドに加える架橋剤の量、および／または架橋時間を変化させることなどによって調節することができる。

【００１１】（実施例２）図２に、本発明の収縮チューブの第二の実施例を示す。この収縮チューブ３０は、それぞれポリエチレンとカーボンブラックとを含む架橋された収縮チューブ部材３１，３２，３３がそれぞれ外層、中層、内層の３層に積層されてなり、その内径は１５０ｍｍ、厚みは２ｍｍとされている。そして、これら各層の架橋度は、外層３１が４０％、中層３２が６０％、内層３３が８５％とされ、外層３１から中層３２、内層３３の順に架橋度が大とされている。

【００１２】この収縮チューブ３０は、例えば外径１００ｍｍの被着体を挿入して赤外線ヒータなどで加熱すると、収縮し、被着体に密着する。このとき収縮は、収縮チューブ３０の口径方向にばかりでなく長さ方向にも起こる。そして、架橋度が大となるほどより強い収縮を起こすので、収縮チューブ３０は口径方向にも長さ方向にも外層３１、中層３２、内層３３の順により強く収縮する。この結果、収縮チューブ３０は、その端末において口径方向の収縮力と長さ方向の収縮力との合力によって被着体に強く圧着され、長さ方向に均一に密着し、端末が被着体から遊離したり、襞が発生したりする不具合が起こらなくなる。また、架橋度が異なる３層に形成されているため、ピンホールがない収縮チューブとなるばかりでなく、外力が加えられても、緩衝力や強靭度が段階的に変化しているので、ピンホールや亀裂が生じにくい品質の収縮チューブとなる。

【００１３】

【発明の効果】以上説明したように、本発明の半導電性収縮チューブは、ポリオレフィンとカーボンブラックとを含む架橋された収縮チューブ部材が２層以上の多層に積層され、各層の架橋度（ゲル分率）が隣接する外層より内層で大とされているので、被着体を挿入して加熱するとき、収縮が不整となって端末が被着体から遊離したり、端末における襞の発生が防止され、施用した収縮チューブの全域にわたって被着体に均一に密着するようになる。また多層構造とされているためにピンホールが発生せず、外力に強い品質の半導電性収縮チューブが得られる。本発明の半導電性収縮チューブを用いることによって、電力ケーブルの接続部において均質な内部半導電層および外部半導電層が形成されるようになる。

【図面の簡単な説明】

【図１】　本発明の半導電性収縮チューブの一実施例を示す斜視図。

【図２】　本発明の半導電性収縮チューブの他の一実施例を示す斜視図。

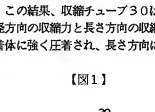
【図３】　電力ケーブルの接続部を示す軸芯に沿う断面図。

【図４】　（ａ），（ｂ）は従来の半導電性収縮チューブの態様を示す斜視図。

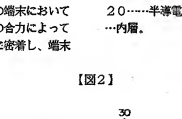
【符号の説明】

２０……半導電性収縮チューブ、２１……外層、２２……内層。

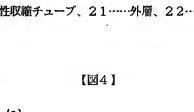
【図１】




【図２】




【図４】




【図３】